

[51] By editing a single camera-motion layer, the entire video sequence relying on the camera-motion layer is modified. With the invention, by only editing a single camera-motion layer, the corresponding sequence of frames in the composite video sequence is affected. Compared to the conventional techniques, the technique of the invention does not require every frame of the video sequence to be edited to effect a change in the resulting composite video sequence.

[52] In general, the modified camera-motion layers include one or more modified original camera-motion layers, one or more deleted original camera-motion layers, and/or one or more added camera-motion layers.

[53] In general, any edits to an original camera-motion layer can be saved by changing the original camera-motion layer to a modified camera-motion layer or by saving a second camera-motion layer incorporating the changes and leaving the original camera-motion layer untouched.

[54] In block 14, one or more original fixed-frame layers are edited by the video editor 4, which results in one or more modified fixed-frame layers. Each fixed-frame layer either can be edited as an original fixed-frame layer or can be edited by converting the original fixed-frame layer to an image and editing the image, as discussed below with respect to Figure 5. Further, various techniques are available editing the fixed-frame layers, as discussed below with respect to Figure 6.

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[57] After blocks 13 and 14 are performed, a decompressed modified video sequence 5 results. The decompressed modified video sequence 5 includes the modified layers from blocks 13 and 14 and any original layers from block 12 that were not modified in blocks 13 and 14.

[58] In block 15, the decompressed modified video sequence 5 is compressed to obtain a compressed video sequence. The decompressed modified video sequence is compressed using, for example, object-based compression as defined in, for example, the main profile of the visual layer of the MPEG-4 international standard.

[59] In block 16, the compressed video sequence is stored and/or transmitted.

[60] In block 17, the compressed video sequence is decompressed to reconstitute the decompressed modified video sequence 5. The decompression in block 17 is the reciprocal technique of the compression in block 15.

[61] Blocks 15, 16, and 17 are performed by the compressor-storage/transmitter/receiver-decompressor 6 in Figure 1, which may be performed by the same computer system or different computer systems.

[62] In block 18, a composite modified video sequence 8 is composed by the object-based video compositor 7 from the decompressed modified video sequence 5. The object-based video compositor 7 uses the camera motion parameters in the decompressed modified video sequence 5 to reproject the camera-motion layers. The composite modified video sequence 8 can be compared to a composite original video sequence obtained from the decomposed original video sequence 3 using the object-based video compositor 7. The composite modified video

sequence 8 differs from such a composite original video sequence depending on the extent of the edits performed by the video editor 4 in blocks 13 and 14.

[63] Various alternatives are available for the flow diagram of Figure 2. For example, block 14 is optional. As another example, blocks 15 and 17 are optional. As a further example, block 16 is optional.

[64] As another option for Figure 2, block 13, in whole or in part, and/or block 14, in whole or in part, can be included with block 18 and performed when the composite modified video sequence is obtained. For example, the camera-motion layer and/or one of the fixed frame layers can be edited during composition. With this option, a user can modify the camera-motion layer and/or one of the fixed-frame layers in real time while viewing the composite modified video sequence. The camera-motion layers and/or the fixed-frame layers can be modified according to any of the techniques described herein. With respect to Figure 4, the camera-motion layer can be modified, for example, by editing the camera motion parameters as in block 46. With respect to Figure 6, one of more of the fixed-frame layers can be modified, for example, by deleting an object as in block 62. As an example, the edits can be performed while the composite modified video sequence is being viewed. The editing can be based on user input from a user input device, such as, for example, a joystick, a mouse, a keyboard, or a stylus.

[65] Figure 3 illustrates a flow diagram for editing a camera-motion layer in block 13 of Figure 2. In block 21, the camera-motion layer is converted to an image. The three-dimensional representation of the camera-motion layer is converted to a two-dimensional representation of the image. The image can be, for example, a JPEG file.

[66] In block 22, the image from block 21 is rectified from the image plane to an ordinary perspective plane. An image, in general, is the projection of the three-dimensional